M14/4/BIOLO/HP3/ENG/TZ2/XX/M

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

May 2014

BIOLOGY

Higher Level

Paper 3

9 pages

Option D — Evolution

1. (a) Carboniferous ***[1]***

(b) 125 (families) *(accept answers in the range of 115 to 135 families)* ***[1]***

(c) reptiles, as mammals appeared before birds ***[1]***

(d) examined/compared fossils ***[1]***

(e) *punctuated equilibrium*
evolution occurs in rapid bursts / interspersed by long periods of stability;
very little change in number of mammal/bird families occurred during Cretaceous period;
but large increase during the Tertiary period;

gradualism
evolution occurs gradually;
the number of amphibian/reptile families did not change much;
number of families do not reflect what happens at species level / *OWTTE*; ***[3 max]***

2. (a) comets / meteorites/meteors ***[1]***
Do not accept asteroids.

(b) self replicating;
can act as catalysts;
(store) genetic information; ***[2 max]***

(c) convergent as wings in both have similar function but different ancestral origin / are analogous structures ***[1]***

(d) constant ratio of ^{14}C to ^{12}C in organism's cells when alive;
when they die this radioactive ^{14}C is converted to ^{12}C;
time for half the ^{14}C to decay is the half-life/5730 years;
ratio of ^{14}C to ^{12}C allows calculation to be made of when organism died; ***[3 max]***

3. (speciation is) the process by which new species arise;
chromosome pairs fail to separate during meiosis;
can lead to individuals/gametes with double/multiples of the normal chromosome number;
polyploids may be well adapted to their environment;
common in plants / named example of speciation by polyploidy;
polyploidy is a form of sympatric speciation;
leading to reproductive isolation from parent species;
polyploid individuals can interbreed with one another;
breeding with diploids/original species leads to infertile hybrids/individuals; ***[6 max]***

Option E — Neurobiology and behaviour

4. (a) 350 seconds / 5 mins 50 seconds *(units required)* ***[1]***

(b) 50 cm *(units required) (accept answers between 47 cm and 53 cm)* ***[1]***

(c) the ant travelled further from nest to the food (than food to nest);
from nest to food took more time / ant travelled slower (than from food to nest);
journey from nest to food less direct/more changes of direction than from food to nest; ***[2 max]***
Do not accept answers stating only numerical values without comparative wording.

(d) (i) memorized direction / magnetic direction / sight/smell of nest ***[1]***
Accept other valid suggestion.
Do not accept left a trail or scent.

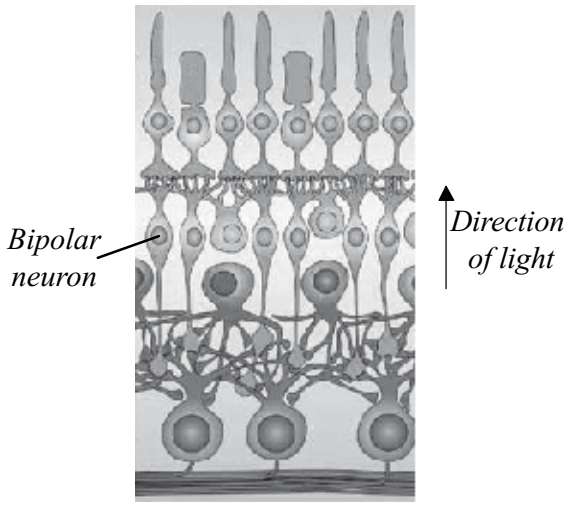
(ii) retrieved a (chemical) trail/scent / communicate with touch/smell ***[1]***
Accept other valid suggestion.

(e) can share work / division of tasks / become specialists / increased protection (because of large numbers) ***[1]***

5. (a) (i) correctly identified bipolar neuron ***[1]***

(ii) arrow pointing upwards ***[1]***

eg.:



(b) (i) amplify the sound (waves)/vibrations;
transmit sound across the middle ear; ***[1 max]***

(ii) sound/vibration/hair movement converted to nerve impulse ***[1]***

(c) *innate behaviour*
innate behaviour present at birth/genetic;
young birds born with a crude template of songs (for their species) / *OWTTE*;
young birds kept in isolation from other birds do not develop proper songs;

learned behaviour
learned behaviour occurs after birth due to experiences/environment / *OWTTE*;
song refinement is learned from other birds / *OWTTE*;
during a sensitive period; ***[3 max]***
Award ***[2 max]*** *if only one type of learning is mentioned.*

6. observe patients/animals with injuries/lesions to a specific part of the brain;
abnormal behaviour linked to lesion/specific brain stimulation;
eg. damage to the occipital lobes affects patients vision / other valid example;
neuroimaging tools/fMRI/EEG;
measures blood flow/glucose uptake/electrical activity in parts of brain during certain activities;
has advantage that studies are carried out on healthy individuals;
experiments may not be carried out on the brains of humans/are unethical;
experiments may be carried on animals but are unethical;
what applies to animals may not be applicable to humans; ***[6 max]***

Option F — Microbes and biotechnology

7. (a) 87°C *(units required) (accept answers in the range of* 86°C *to* 88°C*)* ***[1]***

(b) as pH increases optimum growth temperature increases / directly proportional / positive correlation ***[1]***

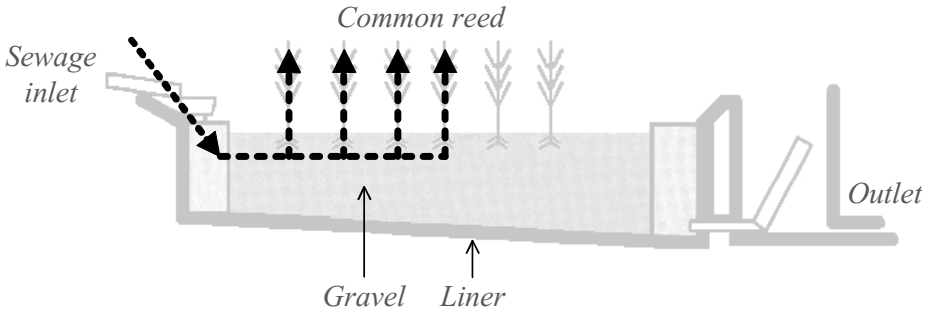
(c) Archaea survive at a greater range of pH than the bacteria;
Archaea can survive at higher temperatures than the bacteria;
Archaea can survive at lower values of pH than the bacteria;
overlap in (optimum) temperature (for the two groups) between pH 5 to 7; ***[2 max]***

(d) there is some overlap between the values;
(overlap) occurs at approximate pH 5 to 7 / temperature about 75 to 88°C;
classification based on other features/DNA/metabolism not considered by the data; ***[2 max]***

(e) anaerobic environments / appropriate example ***[1]***

8. (a) (i) clear annotation indicating movement from (inlet to) gravel bed to reed ***[1]***

eg.:



(ii) decompose organic matter / release nitrates ***[1]***

(b)

	photoautotroph	***photoheterotroph***
energy source	light	light;
carbon source	inorganic compounds / CO_2	organic compounds;

[2]

*Award **[1]** for a correct row or column.*

(c) methane / ethanol ***[1]***

(d) by means of a virus/vector the normal gene is injected/inserted into a cell/chromosome;
to replace the effect of a defective gene;
example of viral vector in gene therapy; *(treatment of SCID allowing the production of enzyme ADA)* ***[2 max]***

9. *irradiation*: ***[3 max]***
involves exposing microorganisms/bacteria to radiation/UV light which damages DNA;
kills bacteria / prevents growth of microorganisms/reproduction (depending on dosage);
may cause changes in taste/chemical composition of food;
can be used on both food and non biotic material (*eg.* glass, hospital equipment);
expensive / people may be reluctant to eat treated food;

pasteurization: ***[3 max]***
involves heating (certain) food to a certain temperature for a specific amount of time / example of temperature and time;
considered safer than irradiation;
kills most but not all bacteria / does not sterilize / slows down the decay of milk/food by killing (some) bacteria;
heat resistant bacteria not killed; ***[6 max]***

Option G — Ecology and conservation

10. (a) decreased ***[1]***

(b) 64 (%) *(units not required) (accept answers in the range of 63 to 65 %)* ***[1]***

(c) there were more chicks/greater density of chicks as more eggs had hatched;
parasite also fed on rats but as there were fewer rats they fed more on chicks;
parasites could have been introduced after rat control / unknown whether there were parasites before rat control; ***[1 max]***

(d) successful as more chicks survived compared with the previous year;
fewer eggs and chicks were eaten by predators;
parasites may cause more harm (than rats);
one year is a short time to predict whether the study was successful; ***[2 max]***

(e) loss of habitat;
loss of their food source/resources;
disease;
competition from other species;
change in climate patterns / other abiotic factor; ***[2 max]***

11. (a) (total) dry mass of organisms;
(total) dry mass of organic matter in ecosystem(s); ***[1 max]***

(b) net production + respiration = gross production ***[1]***

(c) the quadrat positions are determined randomly within the area of the field;
the number of plantain plants in the quadrat is counted each time;
the area of the quadrat and the field are measured; *(both needed)*
apply a formula; ***[2 max]***

(d) species are living in their natural habitat;
they can receive sufficient resources/space;
relatively cheap to set up / easy monitoring / ecotourism / low maintenance;
bigger populations can be conserved / greater gene pool / more genetic diversity;
natural selection occurs normally;
other species are benefitted / no disruption of food chains/webs; ***[3 max]***

12. provide habitat for other organisms / humans live in the rainforests;
absorb a lot of carbon dioxide from the atmosphere / produce oxygen;
rainforests are aesthetically pleasing to visit/inspirational;
provide food as part of food chain/web;
many humans rely on products of rainforests for survival;
may contain chemicals which will prove useful in the future (*eg.* medicines);
allows ecotourism which is of economic importance;
humans have the ethical responsibility to preserve all natural aspects of the planet;
all species have the right to live; ***[6 max]***

Option H — Further human physiology

13. (a) 50 minutes *(units required)* ***[1]***

(b) 4.7 mmol litre^{-1} *(units required)* ***[1]***
Accept answers ranging between 4.6 mmol litre^{-1} and 4.8 mmol litre^{-1}.

(c) in the first 10 minutes/immediately after the meal they both have a significant drop;
concentration of those fed human milk is normally less (than those fed cow milk);
those fed human milk value never goes above normal but it does for those fed cow milk / *OWTTE*;
rises in those fed cow milk in last 30 minutes but drops in those fed human milk;
from 60 to 120 minutes those fed cow milk closer to normal; ***[2]***

(d) emulsifies fat / makes fats more soluble / allows fats to be digested ***[1]***

(e) human milk causes lower/more stable bile salt concentrations (than cow milk);
could mean that fewer bile salts necessary to digest human milk;
more fat is absorbed with human milk;
suggests babies digest/absorb human milk better than cow milk; ***[2 max]***

14. (a) initiate heart beat / (acts as) pacemaker ***[1]***

(b) enteropeptidase / enterokinase ***[1]***

(c) (initially) under nervous control due to the sight/smell of food;
(later) presence of food stimulates hormone gastrin;
gastrin stimulates production of acid/gastric juice; ***[2 max]***

(d) ADH is hormone responsible for regulating water content/osmoregulation;
low water content/concentrated blood detected by osmoregulatory cells in the hypothalamus;
this stimulates the release of ADH from the posterior pituitary gland;
ADH increases the permeability of the collecting duct so more water reabsorbed;
high water content/dilute blood stops/reduces secretion of ADH; ***[3 max]***

15. (statement that) oxygen dissociation curve shows % saturation hemoglobin at different partial O_2 pressures;
annotated diagram of shape of curve;
(in respiring tissues) increase in CO_2 concentration lowers blood pH;
shifts the oxygen dissociation curve to the right (is Bohr shift);
lowers the affinity of hemoglobin for oxygen;
means less oxygen can be carried for same partial O_2 pressure;
oxygen dissociation curve steeper at lower Po_2 corresponding to respiring tissues;
providing even more oxygen to (respiring) tissues;
lungs have high Po_2 and hemoglobin is (almost) saturated / *OWTTE*; ***[6 max]***